

November 13, 2002

The Honorable Richard A. Meserve
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Chairman Meserve:

SUBJECT: RECOMMENDATIONS PROPOSED BY THE OFFICE OF NUCLEAR
REGULATORY RESEARCH FOR RESOLVING GENERIC SAFETY ISSUE-189,
"SUSCEPTIBILITY OF ICE CONDENSER AND MARK III CONTAINMENTS TO
EARLY FAILURE FROM HYDROGEN COMBUSTION DURING A SEVERE
ACCIDENT"

During the 497th meeting of the Advisory Committee on Reactor Safeguards (ACRS), November 7-9, 2002, we reviewed the recommendations proposed by the Office of Nuclear Regulatory Research (RES) to resolve Generic Safety Issue (GSI)-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident." During this review, we had the benefit of discussions with the NRC staff and their contractors, as well as representatives from Duke Energy Corporation. This matter was also discussed during a meeting of the Thermal Hydraulic Phenomena and the Reliability and Probabilistic Risk Assessment Subcommittees on November 5, 2002. We also had the benefit of the documents referenced.

RECOMMENDATIONS

1. Features to resolve GSI-189 should be incorporated into affected plants through plant-specific severe accident mitigation guidelines (SAMGs).
2. The NRC staff should develop guidance on how uncertainties are to be evaluated and considered in regulatory analysis decisions.

DISCUSSION

To reduce the potential for containment failure as a result of detonation of hydrogen generated during severe accidents, ice condenser and Mark III containments are equipped with distributed igniters and air return fans that prevent stratification and enhance the condensing effectiveness of the ice compartment. For station blackout (SBO) events, neither preferred AC nor backup AC power provided by the emergency diesel generators would be available for the igniters and air return fans. Therefore, a potential resolution of this GSI includes the possible addition of a backup diesel generator to power either the igniters or a combination of igniters and air return fans. The addition of passive recombiners is also a consideration.

The RES study reevaluated the role of air return fans on ice condenser containment performance by updating the MELCOR code scoping calculations for the Sequoyah Nuclear Plant and reviewing previous evaluations. As a result of that study, RES concluded that (1) flow conditions inside the ice condenser region are not conducive to producing a transition to detonation, and (2) the operation of the fans merely shifts the burning of the hydrogen more towards the lower containment compartments. Consequently, the staff has concluded that air return fans are not needed to avoid detonation and that the igniters alone are sufficient. We accept this conclusion and the staff's further conclusion that the cost-benefit analysis need only consider backup power for the igniters or the addition of passive recombiners.

The RES staff has conducted a regulatory analysis. At the suggestion of the ACRS, this analysis included consideration of the associated uncertainties. The work scope, however, was not sufficient to conduct a full uncertainty analysis. The uncertainty information utilized for the benefits was estimated from the existing probabilistic risk assessments (PRAs) of relevant plant types.

The "point estimates" of the cost-benefit analysis indicated that only backup diesels for ice condenser plants would pass the benefit minus cost (B-C)¹ test and that the Mark III containments would fail the B-C test (although not by much).

Considering the uncertainties associated with both the costs and the benefits, the B-C for both containment types range from negative to positive, with a substantial amount of the uncertainty distribution on the positive side. The regulatory analysis guidelines should be implemented using the mean value of B-C, and this mean value should be determined in a technically defensible manner. Although the uncertainty estimates in the report were developed in a somewhat ad hoc manner, we believe that they are adequate for this analysis. The NRC staff should develop guidance on the appropriate estimation and treatment of uncertainties.

Although the cost-benefit conclusions were not decisive, considerations of defense-in-depth and public confidence have led the RES staff to conclude that further action by the Office of Nuclear Reactor Regulation is warranted for both containment types. We agree with this assessment, but feel that the justification is not sufficient to support the issuance of an order or a rule. Features to resolve GSI-189 should be incorporated into the appropriate plant-specific SAMGs to allow flexibility for licensees to consider plant-specific options.

Sincerely,

/RA/

George E. Apostolakis
Chairman

¹Commonly known as "Net Present Worth" or "Net Present Value."

References:

1. Memorandum dated October 11, 2002, from Farouk Eltawila, Office of Nuclear Regulatory Research, to John T. Larkins, Advisory Committee on Reactor Safeguards, Subject: RES Proposed Recommendation for Resolving Generic Safety Issue 189: "Susceptibility of Ice Condenser and MARK III Containments to Early Failure from Hydrogen Combustion During a Severe Accident."
2. Letter dated June 17, 2002, from George E. Apostolakis, Chairman, ACRS, to William D. Travers, Executive Director for Operations, NRC, Subject: Recommendations Proposed by the Office of Nuclear Regulatory Research for Resolving Generic Safety Issue-189, "Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident."